



Northern States Power Company

Prairie Island Nuclear Generating Plant

1717 Wakonade Dr. East
Welch, Minnesota 55089

November 24, 1998

10 CFR Part 50
Section 50.73

U S Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

Docket Nos. 50-282 License Nos. DPR-42
50-306 DPR-60

LER 1-98-16

**Negative Flux Rate Reactor Trip Upon Control Rod Insertion
Following Failure of Control Rod Drive Cable**

The Licensee Event Report for this occurrence is attached. In the report, we made no NRC commitments. This event was reported via the Emergency Notification System in accordance with 10CFR50.72 on October 30, 1998. Please contact us if you require additional information related to this event.

Joel P. Sorensen
Plant Manager
Prairie Island Nuclear Generating Plant

c: Regional Administrator - Region III, NRC
NRR Project Manager, NRC
Senior Resident Inspector, NRC
Kris Sanda, State of Minnesota

Attachment

9812010097 981124
PDR ADOCK 05000282
S PDR

Terz

LICENSEE EVENT REPORT (LER)

(See reverse for required number of
digits/characters for each block)ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION
COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO
THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING
BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33),
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE
PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET,
WASHINGTON, DC 20503.

FACILITY NAME (1)

Prairie Island Nuclear Generating Plant Unit 1

DOCKET NUMBER (2)

05000 282

PAGE (3)

1 OF 4

TITLE (4)

Negative flux rate reactor trip upon control rod insertion following failure of control rod drive cable

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
10	29	98	98	-- 16 --	0	11	24	98	Prairie Island Unit 2	05000-306
									FACILITY NAME	DOCKET NUMBER
										05000
OPERATING MODE (9)		1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
			20.2201(b)			20.2203(a)(2)(v)			50.73(a)(2)(i)	50.73(a)(2)(viii)
			20.2203(a)(1)			20.2203(a)(3)(i)			50.73(a)(2)(ii)	50.73(a)(2)(x)
POWER LEVEL (10)		100	20.2203(a)(2)(i)			20.2203(a)(3)(ii)			50.73(a)(2)(iii)	73.71
			20.2203(a)(2)(ii)			20.2203(a)(4)		√	50.73(a)(2)(iv)	OTHER
			20.2203(a)(2)(iii)			50.36(c)(1)			50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
			20.2203(a)(2)(iv)			50.36(c)(2)			50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME

Arne Hunstad

TELEPHONE NUMBER (Include Area Code)

651-388-1121

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPROS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPROS
X	AA	CON	W120	Y					

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE).	√	NO	EXPECTED SUBMISSION	MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On October 29, 1998 Unit 1 was at steady-state, 100% power with the Rod Control System in automatic. At approximately 2350, Unit 1 tripped on a Negative Flux Rate Trip generated by Power Range Nuclear Instrumentation. Subsequent investigation revealed that Control Rod G3 dropped because of equipment failure, and caused the Negative Flux Rate Trip.

LICENSEE EVENT REPORT (LER)

TEXT CONTINUATION

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		98	-- 16 --	00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

EVENT DESCRIPTION

On October 29, 1998 Unit 1 was at steady-state, 100% power with the Rod Control System¹ in automatic. At approximately 2350, Unit 1 tripped from 100% power on a Negative Flux Rate Trip generated by Power Range Nuclear Instrumentation.

Integrated plant response to the trip was normal, with some minor individual equipment problems noted; the operating crew generated Work Orders to deal with those items. Operator response to the trip was timely, appropriate, and in accordance with procedures.

Initial troubleshooting revealed a blown fuse indicator on the positive supply fuse² FU25 for the control rod drive mechanism (CRDM) for control rod G3. No other abnormal indications were observed.

The investigative effort began with inspection of the rod control cabinets and the main control board. The single indication as to the cause of the trip was the one blown fuse indicator. Fuses FU25 (+) and FU29 (-) were removed and tested; both fuses indicated open. Both stationary gripper field wires meggered zero ohms to ground. The short was determined to be under the reactor missile shield, so a cooldown of the reactor coolant system was begun. At cold shutdown, megger testing showed a short to ground in the head area patch cable³ for control rod G3. Megger readings are similar to readings from 2 earlier reactor trips, and strongly point to a failed CRDM patch cable connector.

Two previous unplanned Unit 1 trips occurred in June 1997 and June 1998. As a result of investigation of the cause of those trips, replacements for both units' CRDM and rod position indication (RPI) cables were procured.

All RPI and CRDM head area patch cables were replaced and post-installation testing completed before the unit was restarted.

CAUSE OF THE EVENT

Each of the reactor trips described above occurred due to an internal short circuit developing in the CRDM patch cables at the reactor head connector. The short circuit in each case was attributed to degradation of the Hypalon cable jacket causing chemical attack of the aluminum connector back shell of the patch cable. This resulted in aluminum oxide and water to exist evenly distributed throughout the inside of the connector.

¹ (EIS System Identifier: AA)

² (EIS Component Identifier: FU)

³ (EIS Component Identifier: CBL)

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TEXT CONTINUATION

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

The patch cables were installed in both units in 1989 and 1990 to replace original cables that had embrittled jackets. The replacement cables installed were rated for 90 degrees C. Actual temperature in the area these cables are installed in Unit 1 is approximately 91 degrees C based on thermocouples installed after the first trip. CRDM patch cables have failed only on Unit 1. Unit 2 temperatures are approximately 81 degrees C in the CRDM head connector area.

ANALYSIS OF THE EVENT

A short circuit in the head area patch cable of control rod G3 at the control rod drive mechanism (CRDM) caused the CRDM fuses to open, and the stationary gripper released rod G3, allowing it to drop into the core. The Power Range Nuclear Instrumentation System detected the negative flux rate and appropriately initiated the reactor trip.

The failure mode that led to this reactor trip was identical to two earlier Unit 1 trips. As described in Unit 1 LER 98-008, we requested the Original Equipment Manufacturer to perform a detailed failure analysis on the failed cable. That failure analysis has been completed and its conclusions were:

"Failure of the G7 cable was caused by an electrical short within the connector assembly. The arc track occurred across the surface of the Viton insert between pins A and B (CRDM stationary gripper leads).

The Viton surface was found to be saturated with a water base liquid. Litmus testing of the liquid droplets at the failure sites resulted in pH readings of 4.0.

Chemical analysis of deposits found on the Hypalon jacket and within the G7 connector indicate that breakdown of the Hypalon rubber occurred during operation. pH testing indicated the presence of hydrogen chloride, a product of the Hypalon degradation process.

Water intrusion in combination with hydrogen chloride vapors created the conductive material that shorted pin A to pin B."

Following the June 1998 reactor trip, all CRDM patch cables were sealed at the reactor head to prevent moisture intrusion and tested to ensure no moisture intrusion or other degradation existed. There is no credible source for moisture intrusion at this location due to the high temperature and ventilation systems. It is possible that external moisture intrusion did not contribute to the failure. It is also possible that the moisture found was a process of the chemical reactions occurring between the hydrogen chloride vapors and the aluminum connector shell. No evidence of external moisture intrusion has been identified.

NRC FORM 366A (4-95)		U.S. NUCLEAR REGULATORY COMMISSION			
LICENSEE EVENT REPORT (LER) TEXT CONTINUATION					
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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

This event is reportable under 10CFR50.73(a)(2)(iv) as an unplanned actuation of the reactor protection system. The health and safety of the public were unaffected since the plant systems responded as designed to the automatic trip.

CORRECTIVE ACTION

Two previous unplanned Unit 1 trips occurred in June 1997 and June 1998. As a result of investigation of the cause of those trips, replacements for both units' CRDM and rod position indication (RPI) cables were procured; the replacement cables specify a temperature rating of 150 degrees C. The new cables eliminate two of the required elements for the degradation mode identified; the Hypalon jacket has been replaced with a fiberglass/stainless steel braided jacket and the aluminum connector back shell has been replaced with a stainless steel back shell.

All Unit 1 RPI and CRDM head area patch cables were replaced and post-installation testing completed. Unit 2 cables will be replaced during the current refueling shutdown.

FAILED COMPONENT IDENTIFICATION

The failed component is the CRDM cable assembly to Rod G3. The cable assembly was supplied by Westinghouse (Part No. 8249C08G03).

Westinghouse quit manufacturing CRDM Cables with Hypalon jackets in 1992 and indicated only Prairie Island has experienced failures of these cables due to this degradation mode.

PREVIOUS SIMILAR EVENTS

Two trips due to a faulted head area cable assembly have been reported as Unit 1 Licensee Event Reports 97-008 and 98-008.

CATEGORY 1

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:9812010097 DOC.DATE: 98/11/24 NOTARIZED: NO DOCKET #
FACIL:50-282 Prairie Island Nuclear Station, Unit 1, Northern Stat 05000282
AUTH.NAME AUTHOR AFFILIATION
SORENSEN, J.P. Northern States Power Co.
HUNSTAD, A. Northern States Power Co.
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 98-016-00: on 981029, negative flux rate RT occurred upon
CR insertion after failure of CRD cable. Caused by internal
short circuit developing in CRDM patch cables at reactor
head connector. Replaced CRDM patch cables. With 981124 ltr.

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TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

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